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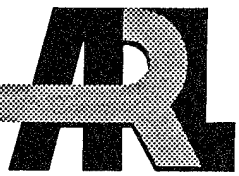

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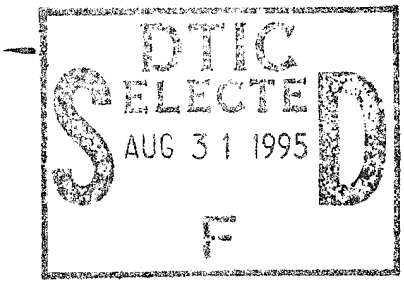
Michael W. Starks

ARL-SR-20 June 1995



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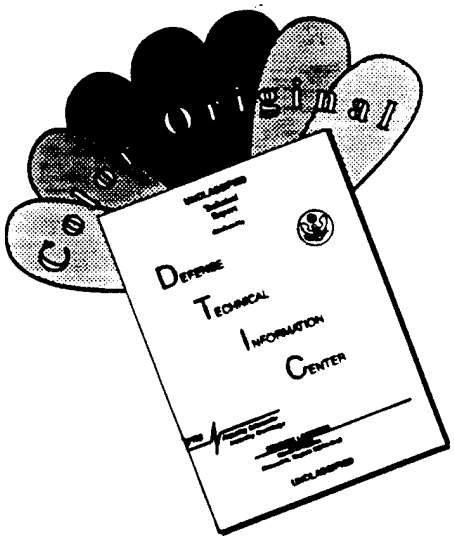

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1. INTRODUCTION

I will show that the Survivability/Lethality Analysis Directorate (SLAD) of the U.S. Army Research Laboratory (ARL) is a success story with respect to reengineering the acquisition process. The historical situation with respect to the Army's process for conducting survivability/lethality analyses will be described and problems with that process will be noted. SLAD's organization and operating process will be described as a response to the historical problems. Most of the paper will cover some of the specific lessons—technical and organizational—that the Army has learned through transition to a reengineered process.

Before the formation of SLAD, it was extremely awkward and excessively costly for Army Project Managers (PMs) to obtain the help they needed to ensure that the materiel they were responsible for developing was properly optimized to ensure survivability on the modern battlefield. For survivability in the face of electronic warfare (EW) threats, the premiere organization was the Vulnerability Assessment Laboratory (VAL) of White Sands Missile Range (WSMR), NM. For nuclear threats, the responsible entity was the Harry Diamond Laboratory (HDL) in Adelphi, MD. For ballistic threats, the provider was the U.S. Army Ballistic Research Laboratory (BRL) of Aberdeen Proving Ground, MD. For chemical and biological threats, including susceptibility to smoke, the U.S. Army Chemical Research, Development, and Engineering Center (CRDEC) at Edgewood Arsenal was the place to go. Each of the organizational entities mentioned thus far was a hands-on provider of survivability analysis to Army PMs and to the acquisition process. In addition, there was a Survivability Management Office (SMO) and a Vulnerability Lethality Assessment Management Office (VLAMO); these offices were trying to perform the herculean task of coordinating the various survivability needs.

Unmentioned so far are the providers of survivability technology in the Army's various Research, Development, and Engineering Centers (RDECs) as well as the U.S. Army Test and Evaluation Command (TECOM), which is responsible for some of the Army's survivability testing. In addition, Training and Doctrine Command (TRADOC) centers and schools are responsible for developing survivability requirements for Army systems. The survivability situation was sufficiently confusing that in 1991 the Deputy Commanding General of the U.S. Army Materiel Command commissioned a major outside review of what was then called the Vulnerability/Lethality/Survivability (VLS) methodology and organizational structure. One of the graphics from that review is shown in Figure 1. It is clearly not a pretty picture.

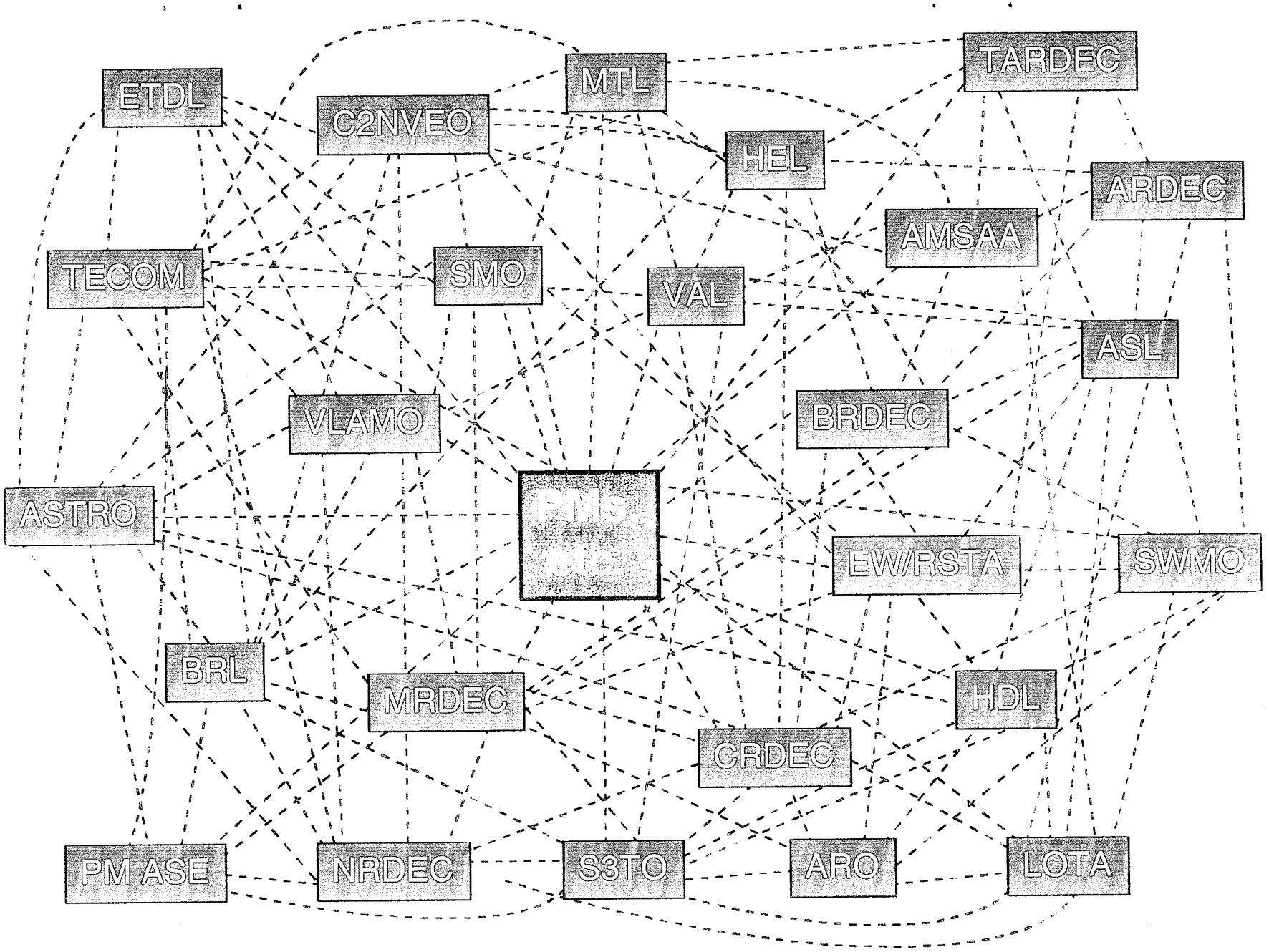


Figure 1. VLS Today.

Exacerbating the organizational diffusion was funding inconsistency. Virtually every kind of Program 6 funds were used in support of the activities I have mentioned. Moreover, some of the organizations mentioned had substantial mission funding for conduct of their work while other organizations had almost none.

A final problem with the pre-SLAD environment was more subtle, but also critically important. Some of the pre-SLAD organizations had the attitude that they were part of the PM's team and that their professional goal was to help the PM field the most survivable materiel possible. Other organizations had the attitude that they were part of the Department of the Army (DA) team which judged whether or not the PM had taken all appropriate action to ensure system survivability. This clash of cultures was not only frustrating to PMs but also caused a fair amount of sniping across organizational boundaries and a lack of uniformity with respect to supporting DA goals.

2. SLAD ORGANIZATION

When SLAD was created, we aimed to provide one-stop shopping for all SLA needs. Although the specific expertise in the various survivability disciplines might have to remain geographically dispersed, our goal was to make this geographical and discipline diversity transparent to our customers. As subsidiary goals, we also aimed to rationalize the funding for SLAD and to build a single culture (Help PMs? Judge PMs?) for conduct of SLA.

Our primary vehicle for achieving all three of these goals was integrated analyses, the planning and resourcing of which was to be implemented by Integrated Analysis Teams. The organizational structure we created to support integrated analysis is shown in Figure 2. The ovals indicate the pre-SLAD organizations who contributed the 500 civil servants, 50 military, and 200 + contractor support personnel who staffed SLAD at its inception in October 1992. Note that the organization is aligned by technical discipline. For purposes of planning and resourcing, however, it is helpful to picture the organization as it is shown in Figure 3. Each area staffer in the Integration Office leads an interdisciplinary integrated analysis team which typically is populated by cost center managers—branch chiefs—from the three line divisions. The teams take the dollar guidance for mission funding they have been given by senior management and conduct a complex planning process for the systems in their purview. Requirements of the supported PMs and of the Independent Evaluators are sought, as are the emphasis areas from HQDA. The teams allocate money versus systems, and also must further allocate the money against discipline—

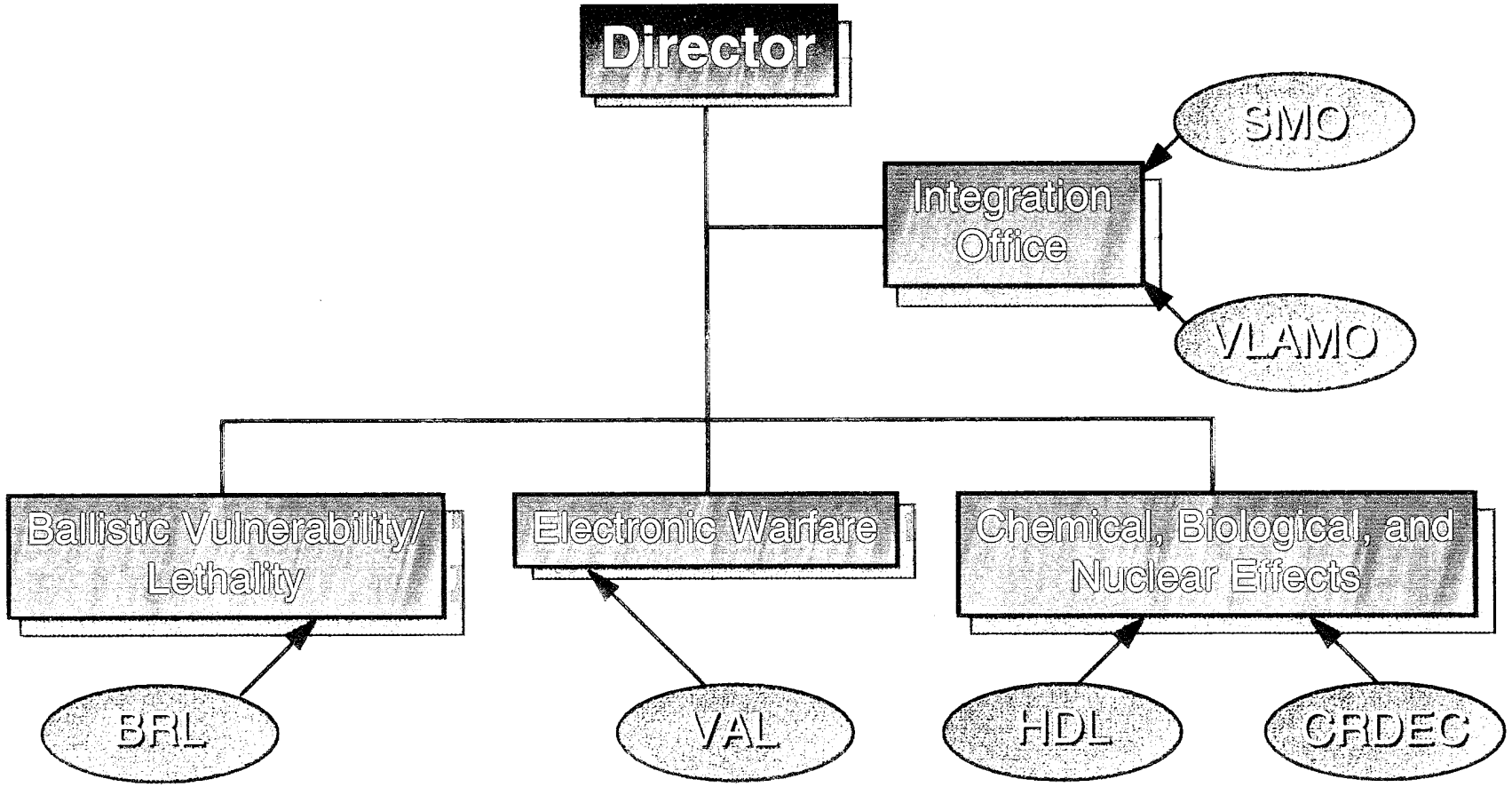


Figure 2. Survivability/Lethality Analysis Directorate.

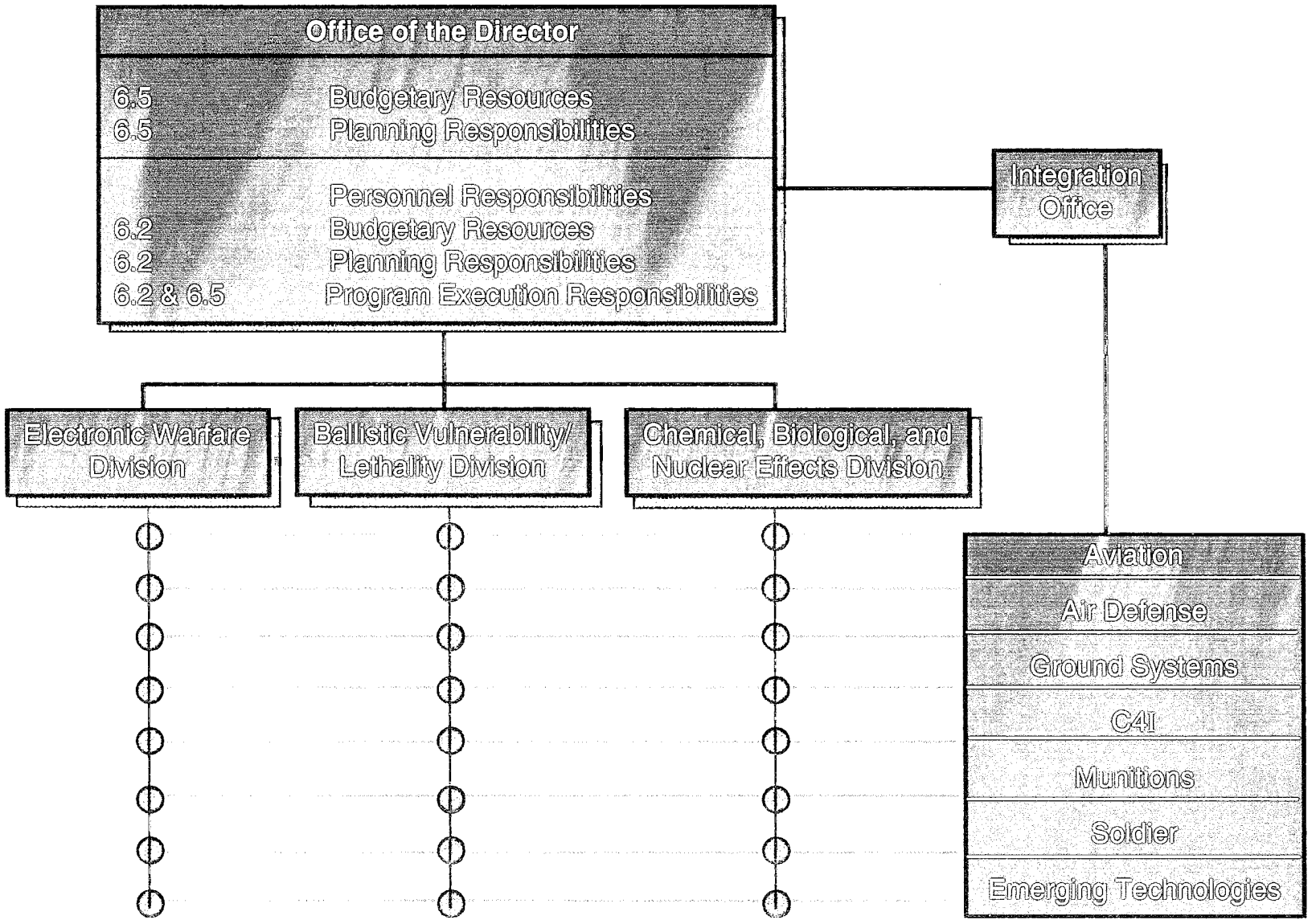


Figure 3. SLAD Program Planning and Execution.

specific tasks in support of those systems. Programs thus developed are approved or modified by an Executive Steering Committee consisting of the three SLAD Division Chiefs and the Chief of the Integration Office.

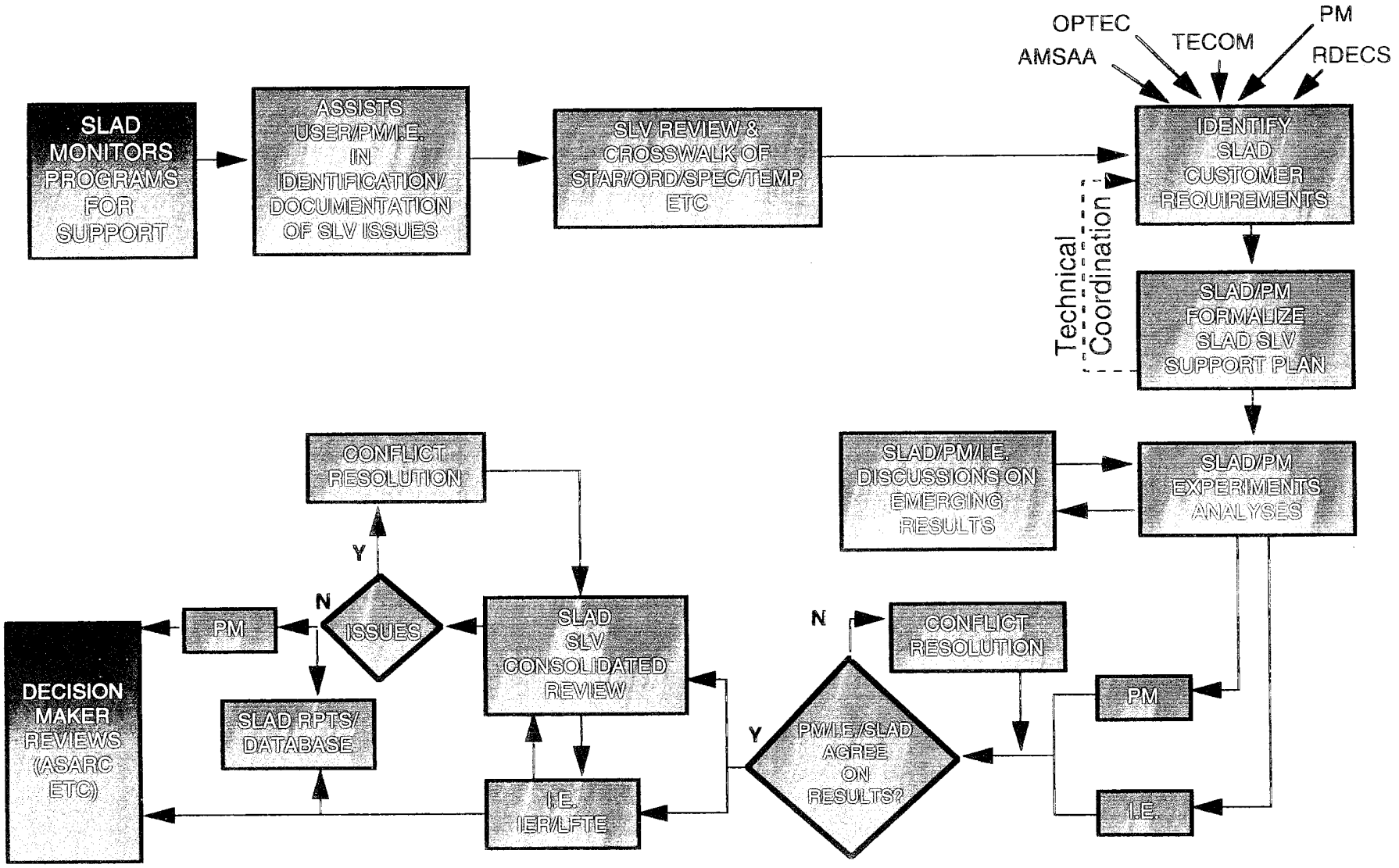
During the planning that led to development of this process, we were also able to bridge the cultural gap between the organizations which regarded themselves as helpers of PMs and those with a self-image as evaluators of PMs. We did this by chartering a Process Action Team (PAT) with representatives from Program Evaluation Offices (PEOs), from the Independent Technical Evaluator, and from SLAD. The PAT developed a very detailed process (Figure 4), according to which SLAD simultaneously makes its data available to the PM (as helper) and to the evaluators. Explicit dispute resolution procedures were also included in the process.

It is worth lingering a moment on the planning scheme I have outlined to make it completely clear how it tends to support achievement of the goals earlier stated. First, the integrated planning process clearly provides the sought-after, one-stop shopping for Army PMs. All a PM needs to know in order to access needed SLAD support is the name of the Integration Office person responsible for his mission area. Second, the process provides the sought-after funding rationalization. On a global basis, SLAD funding guidance is designed both to provide more uniform mission funding support across Integration Areas and to obtain more uniform customer support as well.

It is also worth emphasizing that the integrated planning process just described, and the organizational structure which supports it, was very carefully designed by experienced and senior level practitioners of the various survivability disciplines. This point is important in view of the successes I will attribute to the SLAD process and structure below. Some organizational structures make abstract sense when viewed from a sufficiently high-level perspective, but make considerably less sense when exposed to the crucible of practical application. It is critical to involve experienced subject matter experts in organizational reengineering both to ensure relevance of organizational structure and to guarantee that new organization structures will be properly responsive to real-world business problems.

3. TECHNICAL BENEFIT OF SLAD

We expected to achieve significant new technical synergies when SLAD was formed and we did; I will give an example in the next paragraph. However, we also obtained substantial synergies which we



* Note: Issues/results will be coordinated with the Test Integration Working Group (TIWG) where appropriate.

Figure 4. SLAD Involvement* in the Acquisition Process.

SLAD's short lifetime of just over two years, that process has led to remarkable progress towards a unified SLAD culture and to technical synergies that could not have been predicted when SLAD was created.

The fundamental job of the planning teams is to develop and prioritize the work packages supporting each Army system. This requires, for example, that the teams evaluate the relative importance of an EW work package involving CRUSADER's signature, a conventional ballistics work package involving alternative armor packages, a nuclear, biological, and chemical (NBC) work package concerning collective protection systems, and an environmental work package concerning the capability of CRUSADER's global positioning system (GPS) receiver as a function of precipitation rate. Clearly, a necessary condition on successful accomplishment of the prioritization task is that the team members understand what is to be done in each workpackage and why. In turn, this requires that each team member understand—not necessarily embrace—a fair amount of the technical culture of each SLAD discipline. Over time, however, what has happened is much better than merely having the different cultures understand one another. Over time, many of the participants in the planning process came to believe that it was a waste of energy to devote a great deal of time to translating technical programs into various nonnative vocabularies. (Anyone who has engaged in international negotiations using a translator will readily acknowledge this feeling of frustration.) In a mostly spontaneous way, there was progress towards the goal of having a single SLAD description of the survivability problem, a single vocabulary for discussing the technical details, and a single view of the various tools, techniques, and methodologies used to solve survivability problems.

It would be difficult to overestimate the value of the technical synergies that have resulted from the movement towards a single SLAD culture. Inherently, the aspects of the single-discipline cultures, which have become part of the SLAD culture, are those that are clearest, scientifically soundest, and add the most value to Army systems. After all, we are considering hundreds of SLAD scientists and engineers arguing about these matters; the best ideas are the survivors.

The global synergy resulting from development of a more unified culture yields dozens of specific technical synergies with respect to particular problems. Fault trees used to characterize system capability for one discipline are seen to be useful for another. Software for developing solid-geometry target descriptions are seen as more generally useful than originally believed. Comparable metrics of system capability are developed in each SLAD discipline. This gives benefits measured in both increased efficiency and in improved quality survivability products.

In addition to the efficiencies obtained through the technical synergies mentioned, the formation of SLAD also caused efficiencies of a different kind. As SLAD's planning teams developed and prioritized work packages, some types of work packages were consistently accorded relatively low priority, and consequently fell below the funding cut line. This situation permitted us to realize additional operating efficiencies in two ways; we went out of business areas which were lower priority and we were able to reprogram the labor resources saved into higher value-added activity where there were more high-priority work packages than personnel to execute them.

For example, our EWD operated an airborne platform (BIG CROW) out of Albuquerque, NM. This was an expensive asset to maintain, was useful for evaluation of relatively few Army systems, and was often used in rote testing rather than sophisticated scientific experimentation. Thus this asset was transferred to TECOM which conducts routine technical testing for the Army. The result was not only greater efficiency for SLAD but for the Army's RDA process.

As a second example, our conventional ballistics division had a substantial team of people engaged in very high-resolution force-level modeling for illumination of survivability issues. Many of the work packages prepared by this team did not sift out as high enough priority to be funded. We therefore made the decision to terminate our efforts in that business area and reprogram the labor into improving the utilization of SLAD products within the Army's existing force-level community. As in the first example, the result was improved efficiency, not only in SLAD but for the entire RDA community.

In addition to technical efficiencies of the kind discussed, there have been significant administrative efficiencies realized with the formation of SLAD. For example, many Test Integration Working Groups (TIWG), internal process reviews, quarterly reviews, and other meetings about specific Army systems were formerly attended by each of the five–seven organizations which was involved in survivability for the Army. Now, such meetings can be adequately handled by one–two people, a substantial improvement.

This account of the benefits of SLAD's organization and disciplined planning process would be incomplete without an assessment of customer response. Recall that SLAD's three classes of customers are Army PEOs/PMs, acquisition decision makers, and the Army's Independent Technical Evaluator. Army PMs have been overwhelmingly satisfied with SLAD's one-stop-shopping concept. Instead of engaging in a half-dozen or more negotiations on each separate aspect of survivability, PMs are able to negotiate their entire survivability program at once, with an upfront guarantee that they will not be

blindsided. Indeed, PM enthusiasm about SLAD help is such that SLAD is now a TIWG member and a Test Evaluation Master Plan signatory for every major program. I note that PM satisfaction with SLAD is perfectly consistent with the Defense Department's initiative to reduce the need for PM compliance with arbitrary standards and specifications. The worldwide threat is real and evolving, as all PMs know. Moreover, the direction of that evolution tends to be in the direction of U.S. materiel weakness. Neither PM shops nor their supporting RDECs are staffed with the kind of multidisciplinary survivability expertise which permits SLAD to offer one-stop shopping. For these reasons, Army PMs have eagerly continued to seek SLAD advice even as the community moves away from arbitrary standards and specifications.

The Army's Independent Evaluator (U.S. Army Materiel Systems Analysis Activity [AMSAA]) has been very pleased at SLAD's responsiveness to its specific data requirements. Prior to SLAD, AMSAA scavenged for survivability data in a hit-or-miss fashion. Sometimes AMSAA induced PMs to pay for needed survivability data, and sometimes AMSAA employees were forced to make crude guesses to the detriment of the RDA process. SLAD took the initiative to define AMSAA vulnerability requirements as part of its Army mission. Since that initiative, AMSAA studies have rested on a more consistently credible physical basis than before, and the AMSAA people who conduct such studies have been genuinely appreciative.

Acquisition decision makers have also been well-served by the formation of SLAD. They participate directly in the development, prioritization, and review of SLAD's program; they also reap administrative benefit from the one-stop-shopping concept, especially in the hectic period immediately preceding milestone reviews and other significant decision points. Because there is only one organization for SLAD, the external coordination requirements are greatly simplified.

One way in which the Army's leadership has shown its satisfaction with SLAD's reengineering of the acquisition process is by giving SLAD new missions and new resources to subject to its disciplined planning process. Since the formation of SLAD, we have been given significant new responsibilities in the areas of system capability as a function of the natural environment, electromagnetic environmental effects (E3), and soldier survivability. So it is clear that decision makers prefer SLAD's disciplined planning approach to analysis.

4. ORGANIZATIONAL BARRIERS

SLAD's reengineering success did not take place without the stimulus of various organizational barriers. Since I doubt that these barriers are unique to SLAD, I believe a few of them merit a brief discussion.

One barrier we faced in creating SLAD was geography. When SLAD was first formed, it had significant activity at seven locations in four different states. We are now down to five locations in three states, but the fact remains that our sites are separated by thousands of miles. One might argue that this should be irrelevant in the age of the ethernet and the teleconference (not to mention the telephone and the airplane), but our experience is that it is critical. If a shared culture were already in place, then the technological solutions might suffice. In SLAD, however, it was clear that a new culture had to be built. This process proceeded much more slowly than would have been the case if all of SLAD were collocated in one place.

No single silver bullet enabled us to overcome this problem. We had offsites for senior managers and offsites including junior people. We chartered PATs and various working groups which necessitated face-to-face meetings. The Director and Deputy Director each separately visited every cost center (22) in the organization to explain our vision. We enforced the planning process which involved multidisciplinary teams. And finally, we encouraged division-to-division coordination and integration in every way possible. Much of the difficulty in culture building was garden variety worker resistance to change, but this resistance was much harder to overcome due to SLAD's geographical separation.

A final barrier we had to overcome was resistance to delegated authority from those to whom we were attempting to delegate. As described above, SLAD's planning process forces fundamental prioritization decisions to the lowest possible level in the organization. In the SLAD concept of operations, senior managers review these decisions; they do not make them. This concept of operations is empowering. It is good Total Quality Management (TQM). But it was resisted, at first, by many of those we were trying to empower. I personally found this surprising. Some employees argued that senior management had abdicated its responsibility; others felt that senior management was trying to trick them into making a mistake.

There is no silver bullet for this barrier either. It took time for the workforce to properly apprehend that it really was trusted and empowered. On many occasions, I had to quite explicitly refuse to make decisions which subordinates asked me to make while making the case that a lower organizational level for the decision was appropriate. Eventually, the workforce came to appreciate that they truly were empowered.

5. GENERAL LESSONS LEARNED

I will highlight two pieces of general advice which have been touched on above and which seem to have more general applicability as we in the Defense Department continue to reengineer the acquisition process. The first has to do with the synergies inherent in multidisciplinary forms of organization; the second with traditional distinctions between "white hat" and "black hat" organizations.

In the discussion enumerating the technical synergies resulting from the formation of SLAD, I noted that many of the synergies were a direct result of putting several scientific and engineering disciplines together. I believe that multidisciplinary structures will be the wave of the future as we continue to reengineer. We must avoid single-discipline stovepiping! Organizations which employ, for example, solely atmospheric physics or solely operations research analysis will be inherently less disciplined, less efficient, and less balanced than multidisciplinary organizations like SLAD. Stovepipe organizations are less disciplined because they are not intrinsically forced to consider which skill sets should be brought to bear on a given problem. They are less efficient, because they are inherently unable to realize the technical and administrative synergies that can occur in an organization with multiple areas of expertise. Finally, stovepipe organizations are less balanced because to their hammer, every problem appears as a nail.

My final generic lesson is that we in the Defense Department can no longer afford the luxury of separate "white hat" and "black hat" organizations. Moreover, to have some organizations which help PMs and others which judge PMs is not only expensive, it flies in the face of currently ascendant management theory.

Before defense downsizing, PMs had to pay for survivability help; the Army staff also had to provide mission funds for survivability assessments. Now, increased recognition that separate helpers and assessors are not affordable has led to substantive dollar savings for the DOD. An ironic consequence is

that while SLAD is hard at work playing **both** roles with the same resources, the two sets of proponents are each suggesting that the other should pay the bill. One undesirable consequence of this situation is that SLAD senior management has been required to spend an inordinate amount of time on funding issues. Over time, this has led to strong support for both our missions at HQDA.

Current management theories of quality indicate that if we have flawed output from a business process we should fix the process, not hire additional checkers to monitor the flawed output. In SLAD, we saw above that the goal is to help PMs throughout the acquisition process while simultaneously feeding objective assessments into the RDA decision process as needed. This is simply a better way to reengineer the process than providing a lot of "black hat" checkers; SLAD's success proves that point.

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